Associations of child temperament with child weight and breakfast habits:

A population study in five-year-olds

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Abstract

The aim of this cross-sectional study was to investigate potential associations of child temperament with child weight and breakfast habits. It was hypothesised that children with externalising temperament were more likely to be overweight/obese, and that externalising temperament was associated with not eating daily breakfast. Temperament was controlled for by various child and parental covariates. The sample consisted of 18,047 five-year-olds from the Norwegian Mother and Child Cohort Study (MoBa). Temperament scales were created through principal component analysis (PCA) that showed three dimensions; internalising, externalising, and sociability. Child weight was measured with body mass index percentile-scores, and breakfast habits were differentiated between daily and not daily breakfast. One-way analysis of variance (ANOVA) and Pearson chi-square test of independence were used to assess category differences in the independent variables in relation to the dependent variables. Binary logistic regression was employed to predict categorical outcomes; weight and breakfast. When controlling for other variables, the results showed that children who scored higher on the externalising scale were at a greater risk of being overweight/obese. Those who scored higher on the internalising scale had lower odds of being overweight/obese. Externalising temperament was associated with breakfast consumption, with higher scores indicating lower probability of the child eating daily breakfast. The temperament dimension termed sociability was not significantly associated with weight or breakfast. This thesis study has shown for the first time an association between temperament and weight based on the MoBa sample. Additionally, an association between temperament and breakfast consumption is a novel finding. Access to already retrieved data was provided by the Norwegian Institute of Public Health. This thesis study was independent, not related to a research project.

Keywords: children, temperament, overweight, obesity, breakfast, cross-sectional

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Worldwide, the population is becoming increasingly more overweight and obese. According to the World Health Organization (2015b), obesity prevalence has more than doubled since 1980. In 2013, over 42 million children under the age of five were classified as overweight or obese. Overweight and obesity are described as abnormal fat accumulation (World Health Organization, 2015b). Classification of overweight and obesity is usually defined according to body mass index (BMI), where BMI-values divide between normal weight, overweight and three categories of obesity (Wing & Phelan, 2012; World Health Organization, 2015a; World Health Organization, 2015b). Especially developing countries are struggling with high frequencies of overweight, which is a shift from previously higher occurrence of overweight in developed Western countries (World Health Organization, 2015b).

The increasing prevalence of overweight people might partly result from progressively more *obesogenic* societies, fostering environments where sedentary behaviour is facilitated and inexpensive energy dense food is easily accessible. Fast food chains, elevators, less access to stores selling healthy food, and low prices on unhealthy food are among the aspects that contribute to sustain obesogenic environments (Birch & Anzman, 2010; Guerrieri, Nederkoorn, & Jansen 2008; Leung et al., 2014; Lobstein, Baur, & Uauy, 2004; Ogden, 2010). One serious consequence of the obesogenic societies is the negative health effects for children growing up in them.

Children who become overweight or obese may face several potential health problems, many of the same as for overweight adults (Wing & Phelan, 2012). Asthma, diabetes, hypertension, and coronary heart disease are among the somatic problems they are at risk of obtaining (Baker, Olsen, & Sørensen, 2007; Wing & Phelan, 2012). In addition, overweight children and youth face psychological difficulties related to their excess weight, such as stigmatisation and teasing, which can further lead to depression, anxiety and lowered self-esteem (Puhl & King, 2013; Birch & Anzman, 2010). For instance, Richardson, Goodman, Hastorf, and Dornbusch (1961) have shown that when children were asked to rank drawings of children with different disabilities, the obese child was rated last. This study by Richardson et al. (1961) was replicated 40 years later and the same pattern was found, with obese children rated last and additionally a stronger prejudice towards obese children than in the original study (Latner & Stunkard, 2003). Weight-related teasing can create a vicious circle, where

victimisation is related to binge-eating, increased eating, and lack of physical activity because of isolation (Puhl & King, 2013; Vander Wal & Mitchell, 2011). This pattern can make it hard to lose weight and hence increase the likelihood that stigmatisation continues because of excess weight. There are indications that obesity in childhood increases the risk for obesity in adulthood, and the older the child, the higher is the risk (de Onis & Blössner, 2000; Magarey, Daniels, Boulton, & Cockington, 2003; Martorell, Khan, Hughes, & Grummer-Strawn, 2000; Whitaker, Wright, Pepe, Seidel, & Dietz, 1997; Wing & Phelan, 2012). Because of the grave psychosocial and somatic consequences that overweight children might face, researching possible associations and mechanisms behind such development is necessary.

Temperament

Results from both cross-sectional and prospective studies indicate that there might be an association between overweight and different aspects of temperament in children and infants (Agras, Hammer, McNicholas, & Kraemer, 2004; Anzman & Birch, 2009; Anzman-Frasca, Stifter, Paul, & Birch, 2013; Bradley et al., 2008; Carey, 1985; Carey, Hegvik, & McDevitt, 1988; Darlington & Wright, 2006; Faith & Hittner, 2010; Gong, Ji, & Shan, 2013; Graziano, Kelleher, Calkins, Keane, & Brien, 2012; Hwang et al., 2006; Pulkki-Råback, Elovainio, Kivimäki, Raitakari, & Keltikangas-Järvinen, 2005; Slining, Adair, Goldman, Borja, & Bentley, 2009; Stifter, Anzman-Frasca, Birch, & Voegtline, 2011; Vollrath, Hampson, & Júlíusson, 2012; Wells et al., 1997; Wu, Dixon, Dalton, Tudiver, & Liu, 2011).

Temperament can be described as biologically based individual differences in self-regulation and in reactivity, which entails motoric, emotional, and attentional responses (Rothbart, 1989; Rothbart, 2012; Thomas & Chess, 1977). Although temperament is present at birth and fairly stable over time, it is also influenced and further shaped by life experiences. This interplay can be regarded as a transactional model, where the child's temperament is shaping the environmental reactions (e.g. parental reactions) that further influence the child's temperament (von Tetzchner, 2002). Temperament is additionally considered to be the precursor of individual's personality (Rothbart, 1989; Rothbart, 2012; Thomas & Chess, 1977).

Theories about temperament have existed for a long time. Galen and Vindician, (respectively, second century C.E. and fourth century C.E.) both had theories regarding temperament typologies (Rohtbart, 2012). The fourfold typology presented by Vindician linked temperament to bodily substances and characterised persons as melancholic, choleric, sanguine and phlegmatic (Rothbart, 2012). From the sixteenth century onwards, there was a debate about whether individual development was a result of nature or nurture (Chess &

Thomas, 1996). This discussion largely centred around the viewpoints that human beings were either born with a set of predetermined personality characteristics, also referred to as a *homunculus* (Thomas & Chess, 1977), or that the child was a clean slate, *tabula rasa*, where only environment affected the development (Chess & Thomas, 1996; Thomas & Chess, 1977). The nature-viewpoint received most support until the 19th and 20th century, when environmental determinism and behaviourism gained more influence, with psychologists such as John B. Watson in the forefront (Thomas & Chess, 1977). Later on, both the environmental determinism view and the homunculus-theory were rejected as the sole explanations for development of temperament/personality, and the emphasis shifted towards an interplay between genetics and environment (Rothbart, 2012; Thomas & Chess, 1977).

The New York Longitudinal study (NYLS), conducted by Thomas and Chess in the 1960s, is one of the most well-known clinical studies on temperament in children (Rothbart, 2012). Thomas and Chess (1977) based temperament on nine dimensions; activity level, rhythmicity, approach versus withdrawal, adaptability, threshold, intensity, mood, distractability, and attention span/persistence. Those dimensions led to three temperament types: "easy", "difficult" and "slow to warm up" (Rothbart, 2012; Thomas & Chess, 1977). Because of the terms "easy" and "difficult", being unclear and varying between cultures and studies, it is today more common to use temperament dimensions/types that are more distinct (Rothbart, 2012). Moreover, the term "goodness of fit" characterises the relationship between the child's temperament and the expectations and match with the environment (Rothbart, 2012). The child's temperament can hence be a "good fit" or a "poor fit" depending on parent expectations and perceptions of the child's behaviour (Rothbart, 2012). What is considered "good" or "poor" may thus vary considerably.

Because no consensus has been reached regarding temperament definitions and related questionnaire items, there is not one standard way of measurement. Shared by many of the temperament definitions is the emphasis on emotion, activity, and social aspects, and additionally inclusion of the other dimensions presented by Thomas and Chess (1977). Also the way one self-regulate through attentional processes and effortful control is often included in temperament dimensions (Rothbart, 2012; Anzman-Frasca, Stifter, & Birch, 2012). One of the common classifications are "surgency" (e.g. approach, activity, smiling), "negative affectivity" (e.g. anger, fear, sadness), and "effortful control" (e.g. attention, inhibitory control, pleasure) (Rothbart, 2012). Another way of dividing it is through the following: "externalised negative emotionality" (e.g. aggressive and disobedient), "internalised negative emotionality" (e.g. fearful and sad), and "positive emotionality" (e.g. social and active),

which is also called "surgency/extraversion" (Vollrath, Tonstad, Rothbart, & Hampson, 2011). In this thesis study it will be distinguished between externalising temperament, internalising temperament, and sociability.

Overweight and Externalising Temperament

A study of infants who had gained or lost between 20 and 30 percentile points of weight-for-length between six and 12 months of age, found that the infants who had gained the most weight were characterised by difficult temperament (fussing, crying, bad mood) (Carey, 1985). An association between externalising problems (delinquent and aggressiveness) and overweight in children between 10 and 12 years of age was found by Hwang et al. (2006). Furthermore, a relation between temperamental negativity (anger, fear, sadness, and discomfort) and heavier weight was found in a study regarding infants and toddlers ranging in age from three months to almost three years (Stifter et al., 2011). Moreover, in a study measuring children between six and 12 years of age, there were associations of overweight related to low benevolence and low conscientiousness, which can be regarded as externalising traits (Vollrath, Hampson, & Júlíusson, 2012). One study assessing temperament at the age of one year and weight status at six years of age, found that low attention span with boys was associated with overweight (Faith & Hittner, 2010). Low inhibitory control, which comprises some of the same elements of the low attention span, was associated with heavier weight and weight gain from seven until the age of 15 in a study that measured temperament and weight regarding girls at six time points from ages five to 15 (Anzman & Birch, 2009). In a study measuring temperament in infancy and weight at nine and a half years of age, it was found that highly emotional temperament that comprised negative affect, was associated with overweight (Agras et al., 2004). One study indicated that difficult temperament aspects (for example negative mood and poor adaptability) were connected to more rapid weight gain in children, where temperament was measured between four and five years of age and compared with weight between eight and nine years of age (Carey et al., 1988).

Moreover, a study measured temperament and weight from when the child was six months to around 10 to 12 years of age, with results indicating that children who scored moderate or difficult on several temperament traits in combination with an insensitive mother (less warmth and consideration), had generally higher BMI percentile scores than other children (Wu et al., 2011). Results from a study measuring temperament at birth and weight at one and three years of age, indicated that temperamental negative emotionality was related to rapid weight gain if the mother had low parenting self-efficacy (Anzman-Frasca et al., 2013).

Another study also found associations between negative emotionality and fast weight gain in infants measured at birth and followed up at eight weeks of age (Darlington & Wright, 2006). Distress to limitations was associated with increased weight among infants from when they were three to 18 months old in a study by Slining et al. (2009). A longitudinal study measuring temperament at ages six to 12 and BMI at ages 24 to 30 showed that externalising traits like anger and verbal and physical aggression were related to higher weight than the other temperament dimensions (sociability and activity) (Pulkki-Råback et al., 2005). Some of the mentioned studies had measured internalising and externalising temperament together as negative emotionality (Agras et al., 2004; Anzman-Frasca et al., 2013; Carey, 1985; Carey et al., 1988; Stifter et al., 2011; Wu et al., 2011). Hence, which elements that were most closely associated with overweight cannot be known.

Overweight Related to Internalising Temperament and Sociability

The before mentioned study by Darlington and Wright (2006) also found weight associations regarding internalising temperament. Their results indicated that fear, an aspect of internalising temperament, was related to slow weight gain (Darlington & Wright, 2006). The opposite pattern was found in a study that measured behaviour problems and weight from when the children were two to 14 years old, and found associations between internalising problems and higher weight (Bradley et al., 2008). A study in China found associations between temperament and weight, where positive temperament/sociability was related to higher weight, and negative temperament (externalising and internalising traits) was related to lower weight in infants followed during their first year (Gong et al., 2013). Furthermore, a study regarding 10-year-olds found higher risk for overweight with temperament-based pleasure (laughter, playful activity, and smiling), which can be regarded as surgent/social components (Graziano et al., 2012). The opposite pattern was found in a study among children between six and 12 years of age, where less extraversion was related to a higher likelihood of being overweight or obese (Vollrath, Hampson, & Júlíusson, 2012).

Breakfast and Health

Breakfast has been considered to be the most important meal of the day, with a higher amount of micronutrients compared to other meals (Affenito, 2007). One of the most important aspects of breakfast consumption (which means to literally break the fast) is to refill the low blood glucose levels caused by the overnight fast (Liu, Hwang, Dickerman, & Compher, 2013). Furthermore, a study found that not eating breakfast was related to a less healthy lifestyle, with a poorer nutrient intake (Sjöberg, Hallberg, Höglund, & Hulthén, 2003). The same pattern was found in a study where those who ate breakfast had a better

nutrient intake than the ones who skipped breakfast (Rampersaud, Pereira, Girard, Adams, & Metzl, 2005). There are also indications that eating breakfast inhibits excessive hunger and overeating (Moschonis et al., 2013).

Several studies have also indicated associations in children and young adolescents with not eating breakfast and overweight (Andersen et al., 2005; Grydeland et al., 2012; Haug et al., 2009; Lawman et al., 2014; Moschonis et al., 2013; Nasreddine et al., 2014; O'Dea & Caputi, 2001; Papoutsou et al., 2014; Siega-Riz, Popkin, & Carson, 1998; Smith et al., 2010). There are several possible explanations for this pattern; it may be through increased caloric intake throughout the day and/or that lack of breakfast may represent unhealthy eating or lifestyle patterns that together causes overweight (Affenito et al., 2005; Andersen et al., 2005; Grydeland et al., 2012; Haug et al., 2009; Moschonis et al., 2013; Nasreddine et al., 2014; Papoutsou et al., 2014; Smith et al., 2010).

Breakfast and Performances

Cognitive, attentional and memory performances have also been connected to children's breakfast eating. One study showed that among preschool-children, those who consumed breakfast regularly performed better academically at various IQ-tests, than did children who did not eat regular breakfast (Liu et al., 2013). Moreover, not eating breakfast was related to impaired attention and episodic memory in a study of children/adolescents from nine to 16 years of age (Wesnes, Pincock, Richardson, Helm, & Hails, 2003). Further support for breakfast's beneficial influence on cognitive performance was found in a study examining children from nine to 11 years of age (Mahoney, Taylor, Kanarek, & Samuel, 2005).

Eating Habits and Temperament

To the author's knowledge, there seems to be no research regarding temperament and breakfast habits in children. However, some studies have connected temperament to various eating patterns in children. Although they do not deal with breakfast, they illustrate temperament's role regarding general eating habits. In a cross-sectional study investigating children between three and eight years of age, it was revealed that emotional temperament (gets easily upset) was related to food avoidant eating behaviour (Haycraft, Farrow, Meyer, Powell, & Blissett, 2011). Furthermore, another study examining pre-schoolers found partly the same pattern, as children with negative affectivity were less likely to eat in absence of hunger but also that the temperament dimension surgency was related to eating elicited by external cues (Leung et al., 2014). In a cross-sectional study examining personality and eating patterns for children between six and 12 years of age, results indicated that traits linked to difficult temperament (neuroticism, low benevolence, and low conscientiousness) were more

inclined to intake of sweet drinks (Vollrath, Hampson, & Júlíusson, 2012). Additionally, a prospective longitudinal study measured temperament when the child was one and a half years old and examined eating habits at ages three and seven, and found that both internalising and externalising temperament at one and a half years of age increased the odds for consumption of sweet drinks and food at ages three and/or seven (Vollrath, Stene-Larsen, Tonstad, Rothbart, & Hampson, 2012). Support for the relation between externalising/difficult temperament and unhealthy food habits was also found in a prospective study examining 12 weeks old infants where the ones characterised as irritable and restless consumed more carbohydrates at follow-up (two/three years of age) than did other infants (Wells et al., 1997).

Biosocial Influences on Child Weight Status and Eating Habits

The main influence on weight status is the balance between energy intake and energy expenditure, represented by eating and physical activity (Jago, Baranowski, Baranowski, Thompson, & Greaves, 2005; Ogden, 2010; Stunkard, Berkowitz, Schoeller, Maislin, & Stallings, 2004; Wing & Phelan, 2012). For children, both own and parental characteristics influence this interplay between eating and activity. Some factors that seem to have an impact are parental education/socioeconomic status, maternal body mass index (BMI), parent's marital/partner status, and the child's television viewing/computer use as a proxy for lack of physical activity.

Socioeconomic status and education. Obesity has been characterised as a socioeconomic problem (Drewnowski & Specter, 2004), with higher overweight rates among poor and less educated populations. Some areas in the United States with large proportions of people with lower socioeconomic status are characterised by obesogenic factors including less supermarket access, more fast food chains, and less access to physical activities (Lovasi, Hutson, Guerra, & Neckerman, 2009). Having a low income can be a barrier to purchase of healthy food, and less knowledge about nutrition can further facilitate overweight (Birch & Anzman, 2010; Thornton, Pearce, & Ball, 2013). Several studies have observed that parental lower education or low socioeconomic status is associated with a higher degree of overweight or obesity in children (Brekke, van Odijk, & Ludvigsson, 2007; Danielzik, Czerwinski-Mast, Langnäse, Dilba, & Müller, 2004; Dubois & Girard, 2006; Fernández-Alvira et al., 2013; Flores & Lin, 2013; Grydeland et al., 2012; Hawkins, Cole, & Law, 2008; Hesketh, Crawford, Salmon, Jackson, & Campbell, 2007; Shrewsbury & Wardle, 2008; Stunkard, Berkowitz, Schoeller, Maislin, & Stallings, 2004; Thorisdottir, Gunnarsdottir, & Thorsdottir, 2013). Lower parental education level has also been associated with unhealthy eating and dietary

habits in children, with for example higher intake of sugary food and drinks (Brekke et al., 2007; Kiefte-de Jong et al., 2012; Thorisdottir et al., 2013; Thornton et al., 2013).

Nevertheless, there are cultural differences in regard to socioeconomic status and its role concerning weight and diet. For instance in an Egyptian and Bahraini sample, a higher risk for being overweight was displayed if parents had higher education (Jackson, Rashed, & Saad-Eldin, 2003; Musaiger, Al-Roomi, & Bader, 2014). The same pattern was found in an Iranian study, where maternal higher education was related to overweight in children between six and 11 years of age (Maddah & Nikooyeh, 2009). There has been a considerable "adoption" of western food high in fat, sugar and salt, and sedentary lifestyle aspects, which some call the "nutrition transition" in some of the non-Western and developing countries (Popkin, 2001), which may be one of the aspects that have led to the increasing prevalence of obesity among youth and adults in those countries (Martorell et al., 2000; Popkin, 2001). However, one study executed in Hong Kong and one in Lebanon discovered essentially the same pattern as in the Western studies, where children of highly educated parents and children of parents with profession occupation, were less overweight or showed more positive weight changes than did other children (Au & Yu, 2014; Nasreddine et al., 2014).

Physical activity, sedentariness, and technology. Lack of physical activity is one of the most important determinants of overweight (Jago et al., 2005; Ogden, 2010). Physical activity can either be measured with focus on activity in itself or by looking at the opposite – sedentariness. In today's obesogenic environments, several media elements that facilitate sedentary behaviour have emerged, including television, computers/tablets, and smart phones (Ogden, 2010; Vandewater & Denis, 2011). Several studies have found linkages between increased television watching and overweight in children (Andersen et al., 2005; Dennison, Erb, & Jenkins, 2002; Grydeland et al., 2012; Jago et al., 2005; Marshall, Biddle, Gorely, Cameron, & Murdey, 2004; Müller, Koertzinger, Mast, Langnäse, & Grund, 1999; Musaiger et al., 2014; Parsons, Manor, & Power, 2008; Wake, Hesketh, & Waters, 2003). Moreover, in an adolescent sample, prevalent computer use was associated with increased risk of overweight (Lajunen et al., 2007).

Some researchers are sceptical regarding the clinical relevance of television in relation to overweight, as it might be other mechanisms behind this association (Marshall et al., 2004; Vandewater & Denis, 2011). It has been hypothesised that media elements such as television, computers and smart phones mainly replace other sedentary activities (Vandewater & Denis, 2011). This is illustrated with a study by Epstein, Paluch, Gordy, & Dorn (2000) which showed that when trying to reduce specific sedentary behaviours and increase physical

activity, the targeted sedentary behaviours were by some children replaced with others, especially if there were no available physical activities of interest to the children. If unhealthy eating is accompanying television viewing, this can contribute to a higher BMI. One study with an adolescent sample provided associations between television viewing and increased consumption of sweetened beverages and lower fruit consumption (Santaliestra-Pasías et al., 2012). Additionally, there was an association between eating energy-dense food when watching television, which was in turn associated with BMI (Matheson, Killen, Wang, Varady, & Robinson, 2004). Food commercials can also facilitate unhealthy eating in children (Borzekowski & Robinson, 2001; Buijzen, Schuurman, & Bomhof, 2008; Harris, Bargh, & Brownell, 2009; Must, Barish, & Bandini, 2009). The possible connection between television use and inactivity and eating illustrates the fact that it might be behaviour accompanying television viewing that may result in weight gain.

Parental overweight. The results of multiple studies indicate an association between parental overweight and child overweight, in particular maternal overweight (Agras et al., 2004; Agras & Mascola, 2005; Burke, Beilin, & Dunbar, 2001; Faith & Hittner, 2010; Gibson et al., 2007; Pryor, 2011; Rooney, Mathiason, & Schauberger, 2011; Whitaker, 2004). The way the maternal BMI influences the child's weight has been linked to a genetic heritability, where the mother's overweight during pregnancy might imply a likelihood for the offspring to have a high birth weight (Whitaker, 2004). But it can also be a family lifestyle with obesogenic characteristics that influences the child and thus leads to overweight (Birch & Anzman, 2010; Brekke et al., 2007; Fisher, Mitchell, Smiciklas-Wright, & Birch, 2002; Vereecken, Keukelier, & Maes, 2004). In one study, the only predictor of the children's eating habits was maternal consumption (Vereecken et al., 2004), highlighting the important role of parents when it comes to modelling healthy eating (Birch & Anzman, 2010).

The familial and environmental effect can even begin in utero, when the amniotic fluid is affected by the mother's diet (Birch, 1999). Research on genetics in the light of obesity has led to findings of common variation in a fat mass and obesity associated (FTO) gene, which may be connected to obesity in childhood and adulthood (Frayling et al., 2007). Furthermore, on the background of twin studies, it has been suggested that genetic factors explain around 50% to 90% of the variance seen in BMI (Maes, Neale, & Eaves, 1997). However, as it is stressed by these authors (Frayling et al., 2007; Maes et al., 1997), the way genetics impact weight works along with environmental factors. The diathesis/stress-model suggests that some people are more susceptible to environmental factors based on biological congenital aspects (Belsky & Pluess, 2009). This model has been used to explain the interaction between

temperament and overweight, where temperament (genetic predisposition) is shaped by experiences/environmental factors (obesogenic elements), which can further lead to for example overweight (Stifter, Anzman-Frasca, Birch, & Voegtline, 2011). This interplay between genetics and environment has further emphasised the assumption that genetics may always have affected individuals at risk or not for overweight. However, with today's obesogenic environments, having possibly this obesity predisposition may make it harder to maintain healthy lifestyle choices than in earlier times (Anzman-Frasca et al., 2012; Dubois & Girard, 2006; Wadden, Brownell, & Foster, 2002; Wardle, Carnell, Haworth, & Plomin, 2008).

Parental marital/partner status. Some studies have found indications of an association between parental marital status (single parents/divorce) and overweight children (Elfhag & Rasmussen, 2008; Gable & Lutz, 2000; Gerald, Anderson, Johnson, Hoff, & Trimm, 1994; Hesketh et al., 2007; Yannakoulia et al., 2008). It has been proposed that single parents might be less restrictive when it comes to unhealthy eating (Hesketh et al., 2007). In line with this, Brekke et al. (2007) observed that if the mother was single, there was a higher frequency of consuming food low in nutrition and high in sugar than in other families. In accordance with this pattern, one study found that the daughters of single mothers were characterised by more restrained eating and they had a higher intake of soft drinks compared to children who did not have single mothers (Elfhag & Rasmussen, 2008). Furthermore, among children who were five to six and 10 to 12 years old, an unhealthy diet and television-viewing was moderately associated with parents' marital status (Leech, McNaughton, & Timperio, 2014). Additionally, skipping breakfast among children between two and five years of age was associated with having single parents (Küpers, de Pijper, Sauer, Stolk, & Corpeleijn, 2014), which further advocates for an unhealthy eating pattern linked with single parents.

Mechanisms Relating Temperament with Weight and Eating Habits

The mechanisms behind the relation between temperament and weight are not fully understood. One assumption is that temperament elicits certain responses in the environment that further causes increased weight but the opposite have also been proposed – that weight is affecting the temperament (Anzman-Frasca et al., 2012; Bergmeier, Skouteris, Horwood, Hooley, & Richardson, 2014; Snethen, Hewitt, & Goretzke, 2007). Some of the possible mechanisms that have been hypothesised are self-regulation disruption related to appetite, impulsivity and reward sensitivity, food to soothe, emotional eating, and food preferences.

Feeding to soothe can lead to excess weight because of increased caloric intake (Darlington & Wright, 2006; Stifter et al., 2011), especially if the food used to soothe is energy dense (Vollrath et al., 2011). In addition, overly controlled feeding and using food as a soothing mechanism can lead to disruption of the child's self-regulation of food intake, where external cues related to food becomes more relevant for the child than internal cues for hunger (Agras et al., 2004; Bergmeier et al., 2014; Fisher & Birch, 2002). One study has indicated that self-regulation difficulties in two-year-olds predicted obesity eight years later (Graziano et al., 2012), emphasising long-term effects of poor self-regulation. Emotional eating, which is overeating elicited by emotions (for instance, when feeling sad), is a well-known phenomenon when it comes to adults, and research has indicated that this is occurring in children as well (Braet & van Strien, 1997). If the child gets used to food as an emotional stabiliser from early on by parents using food to soothe, an emotional eating pattern can possibly form, entailing that food can later be used as a calming tool.

A study by Francis and Susman (2009) using laboratory tasks indicated that obese adolescents had lower inhibitory control and displayed larger levels of impulsivity. Another study supporting this (Braet, Claus, Verbeken, & Van Vlierberghe, 2007) found more impulsiveness among the overweight children than among normal weight children. These traits have been claimed to be risk factors for overweight by van den Berg et al. (2011), since they possibly relate to overeating and low attention to food cues. What is more, it has been speculated that overweight children have a stronger relation with food reward than non-overweight children (Temple, Legierski, Giacomelli, Salvy & Epstein, 2008; Faith & Hittner, 2010). One study showed increased reward sensitivity among overweight children, illustrating that increased reward sensitivity can work as a risk factor for development of overweight through overeating (Verbeken, Braet, Lammertyn, Goossens, & Moens, 2012). According to Guerrieri et al. (2008), the variety that exists regarding unhealthy food, and the accessibility of it, can pose as a problem when it comes to reward responsiveness in children, since some individuals are more prone to instant gratification and hence can find it challenging to resist the energy-dense food.

Certain food preferences can arise in early childhood. It has been proposed that individuals with high reward sensitivity might have stronger preference for sweet food and drinks (Vollrath, Stene-Larsen et al., 2012). One study showed that children at risk of obesity (having obese parents) had a greater preference for energy dense food, a stronger desire towards food and drinks in general, and a larger inclination towards sedentary behaviour compared with children not at risk of developing obesity (normal weight parents) (Wardle,

Guthrie, Sanderson, Birch, & Plomin, 2001). The development of preference for an obesogenic diet has been stressed by Birch and Anzman (2010), since children can get used to easily accessible and energy-dense food.

The association between temperament and breakfast/eating habits might be connected to certain temperament components. Especially, elements of externalising temperament, like easily upset, neuroticism, low benevolence, low conscientiousness, being irritable, and restless, have in several studies been linked to unhealthy eating habits (Haycraft et al., 2011; Vollrath, Hampson, & Júlíusson, 2012; Vollrath, Stene-Larsen et al., 2012; Wells et al., 1997). Furthermore, hyperactivity and impulsivity have been connected to reward sensitivity and delay of gratification (van den Berg et al., 2011; Braet et al., 2007; Faith & Hittner, 2010), which can impact the eating patterns through unhealthy preferences and an emotional connection with food.

Deficits of Earlier Studies and What This Study Will Add

Several studies that have investigated the relation between temperament and weight and temperament and eating have found associations with temperamental negative emotionality, including anger, defiant, fear, fussing, crying, and distress to limitations. Also, a short attention span, lower inhibitory control and externalising problems have been linked to overweight and eating habits. However, some studies have not investigated internalising and externalising dimensions separately, leaving out possible independent associations that the dimensions might have with weight or eating. Since the studies researching temperament and weight have generated quite different results, mapping what dimensions and components that are possibly related to child overweight and eating habits is important.

Furthermore, no research has investigated the possible relation between temperament and breakfast habits in children. Several studies have examined breakfast's role regarding health and nutrition and also the way it might influence cognition and academic performance. Moreover, some studies have revealed associations between temperament and general eating habits but not included breakfast. Whether there additionally might be temperament-related associations with breakfast is thus interesting to explore, in order to better understand children's eating patterns. Also, since breakfast seems to be a vital element in a healthy lifestyle, it is important to investigate mechanisms that inhibit or facilitate breakfast.

The present study's aim was to explore further the associations that in some studies have been found between temperament and weight. Additionally, it was investigated whether there might be a relation between temperament and breakfast consumption. This thesis study also included a variety of possible covariates, to see whether they may influence the results. In

addition to more established covariates such as parental education/socioeconomic status, maternal BMI, parent's marital status, and television viewing/computer use, some other covariates that have not generated as much research in this context will be included here. These are maternal self-esteem, maternal mental health (SCL-5), maternal weight control, household members represented by siblings, and maternal physical activity. Based on the aim of the study, two hypotheses were tested:

Hypothesis 1: children with externalising temperament are more likely to be overweight or obese.

Hypothesis 2: children with externalising temperament are more likely not to eat breakfast every day.

Method

Sample and Data

This thesis employed data from the ongoing Norwegian Mother and Child Cohort Study (MoBa), conducted by the Norwegian Institute of Public Health. The MoBa study recruited pregnant women from 1999 to 2008 and have collected information regarding more than 100,000 pregnancies. The first MoBa questionnaire is at the 17th week of gestation and the last one so far is when the child is eight years old (Norwegian Institute of Public Health, 2012). The MoBa study's aim is to collect data on different types of risk factors and health outcomes, in order to be able to prevent and map important diseases and exposures (Magnus, et al., 2006). Recruitment of participants was done through invitations to pregnant women given together with their appointment cards for ultrasound scanning in week 17 of gestation. All hospitals and maternity units in Norway with more than 100 births each year were invited to participate, which included 52 units. In 2006, 50 units had participated in the study. The participation rate for all of the invited pregnancies was 42.7% (Magnus et al., 2006). The questionnaires contain queries regarding the child, the mother, and also the father of the child. The study in this thesis obtained approval from the MoBa study, which further has approval from the Regional Committees for Medical and Health Research Ethics (REC/REK) sør-øst. This thesis used questionnaire data from when the child was five years old, and questionnaire 1, which is at week 17 of gestation.

Dependent Variables

For all the dependent variables, independent variables and the covariates, descriptive results will be displayed in Table 1.

BMI percentile-scores for both the children and the mothers were created using the weight and height variables from the questionnaires. Children's height and weight and

mothers' weight was retrieved from the five-year-questionnaire, whereas the mothers' height was retrieved from the first questionnaire. In order to create the BMI percentile-scores, elimination of unrealistic weight and height values was conducted. Then a variable for height in meters was made. The BMI percentile-values were generated by dividing weight in kilograms by the square of height in meters (kg/m^2). In order to create BMI percentile-scores for children, information regarding the growth curves for Norwegian children by Júlíusson et al. (2009) was used as guideline for overweight and obesity cut-off-points among five-year-olds. For adults, the regular procedure for BMI scores was employed (kg/m^2), where normal weight ranges from 18.50 to 24.99, overweight ranges from 25.00 to 29.99, and obesity ranges from 30.00 and onwards (World Health Organization, 2015a). There were quite few obese participants (see Table 1), therefore for analysis purposes overweight and obesity was combined into one category for both children and mothers.

Breakfast consumption was measured in the five-year-questionnaire with the query: "how often does the child eat breakfast (at home or in the kindergarten)?". Response categories for breakfast were: "rarely/never", "once a week", "2–3 times a week", "4–6 times a week", and "every day". A dichotomous variable was made in order to separate between breakfast every day and not every day, in order to measure breakfast as a daily routine (missing values for breakfast=287).

Independent Variables

Temperament dimensions were created with 12 statements regarding the child's temperament/personality style that are based on items from the Emotionality, Activity, and Sociability (EAS) Questionnaire, and 27 statements regarding activity/behaviour that was based on items from the Child Behavior Checklist (CBCL). Both the temperament and the activity questions were retrieved from the five-year-questionnaire data. To create temperament scales, the variables regarding temperament/personality style and activity/behaviour were recoded so that the scales and the direction of the answers were alike. The variables regarding temperament and personality style had five levels on a Likert-type scale, ranging from "very typical" to "not at all typical". The variables concerning the activity/behaviour had answers on a three point Likert-type scale, where the points went from "never/rarely" to "often/typical". Therefore the variables had to be recoded so that a high score reflected "typical", and decimal levels had to be added, so that the middle answers regarding the temperament items were included. The range went from 0 to 2. All variables from the temperament and personality style were used in the Principal Component Analysis. The three variables; ″doesn't eat well", "stomach aches or cramps (without medical cause)",

and "vomiting/throwing up (without medical cause)", from the activity/behaviour block were excluded, because they were thought to measure something else than temperament-related behaviour. The total number of variables to be analysed was 36.

Covariates

Child gender was included in the analyses, with 51.0 % boys, and 48.8 % girls (26 participants missing).

Marital/partner status was retrieved from questionnaire 1 and was originally distinguishing between "married", "cohabitant", "single", "divorced/separated", "widow", and "other". In the present study, marital status was made into a dichotomous variable differentiating between married/cohabitant and single/divorced/separated/widow. "Other" and participants who had scored on several was categorized as missing (n=177).

Parental education was retrieved from questionnaire 1 where it was grouped into seven response categories: "9 years primary school", "1–2 years high school", "vocational high school", "3 years general high school", "college/university up to 4 years", "college/university more than 4 years", and "other education". A dichotomous variable combining both parents' education was created, distinguishing between either one or both parents with college/university education and neither of them having college/university education. In the questionnaire, there was one query regarding finished education and one regarding ongoing education. For those who only had ongoing education, the one they were currently completing was the one that counted. For those who had answered both questions, the highest education was the one that counted. Questions regarding other types of education were not included in the analyses (235 answers were missing).

In the five-year-questionnaire, there were queries regarding use of media and games. The ones included in the analyses were; whether the child had a television in her/his room (yes or no), how many hours the child watched TV/DVD or played PC/TV-games on (1) a typical day in the week and (2) on a typical day in the weekend, and finally how often the child used computer at home. The answer categories for hours watching TV/DVD or playing PC/TV-games were: "never", "less than 1 hour", "from 1 up to 3 hours", "from 3 up to 5 hours", and "5 hours or more". The response categories for child use of computer at home were: "daily", "4–6 times a week", "2–3 days a week", "1 day a week", and "never/rarely". The questions regarding number of hours watching TV/DVD or playing PC/TV-games were combined into one variable measuring both the number of hours on a typical day in the week and on a typical day in the weekend. The media variables were assumed to be representative

of measuring child sedentariness by proxy (missing values on television in child room=150, missing values on hours TV/PC=70, missing values on how often PC=109).

The five-year questionnaire included a question regarding whether the mother lived with the child's father. There were three answering options: "yes", "no", and "have never lived with the child's father". The answers were separated into two categories, where "no" and "have never lived with the child's father" was combined into one category and the other one was "yes" (missing values=67).

From questionnaire 1, the mothers' self-esteem was measured with four statements where the response options ranged from "agree completely", "agree", "disagree", and "disagree completely". The four statements were: (1) "I have a positive attitude towards myself", (2) "I feel completely useless at times", (3) "I feel that I do not have much to be proud about", and (4) "I feel that I am a valuable person, as good as anyone else". A variable was created to measure self-esteem using participants' mean scores, where at least two of the statements had to be answered by the mothers in order for them to be included. This corresponds to substitute the missing values with the mean of the non-missing values.

The Hopkins Symptom Checklist-5 (SCL-5), which is an instrument used to measure mental health, was assessed regarding the mothers in the 5-year questionnaire. SCL-5 consists of eight variables where you are asked to indicate if you have been bothered with any of them over the last two weeks: (1) "feeling fearful", (2) "nervousness or shakiness inside", (3) "feeling hopeless about the future", (4) "feeling blue", (5) "worrying too much about things", (6) "feeling everything is an effort", (7) "feeling tense or keyed up", and (8) "suddenly scared for no reason". The answer categories were: "not bothered", "a little bothered", "quite bothered", and "very much bothered". Mean scores were created to measure SCL-5, where at least four of the statements had to be answered by each respondent in order for them to be included.

The mothers' physical activity was measured in questionnaire 1. The question was: how often are you so physically active in your leisure and/or at work that you get out of breath or sweat? Only leisure time was included in the analyses. The question was dividing between the last three months before the current pregnancy and during the current pregnancy. The response categories were: "never", "less than once a week", "once a week", "2 times a week", "3–4 times a week", and "5 times a week or more". For both the before pregnancy question and the during pregnancy question, variables were created where the answer categories were divided between "less than two times a week" and "two or more times a week". This categorization was based on the fact that half of the questions were entailing less

than two times a week, whereas the other half consisted of two or more times a week (missing values before pregnancy=497, missing values during pregnancy=614).

A question regarding how many children there were in the household was retrieved from the five-year questionnaire (data set items differed from questionnaire, hence the data set items are described here). The question had four answering alternatives: (1) "number of children older than 9 years", (2) "number of children from 5 years old up to 9 years old", (3) "number of children 3 or 4 years old", and (4) "number of children from 0 to 3 years old". The answers from each respondent were added together, so that there was a score for the total amount of children. One answer was "30 children", which was excluded as an outlier because it was possibly a result of wrong data entry (missing values=2,856).

In questionnaire 1 there were six questions regarding weight and weight control that were included in the present study: (1) "do you think you were overweight just before this pregnancy?", (2) "are you worried about gaining more weight than necessary during this pregnancy?", (3) "has anyone said that you were too thin while you felt that you were overweight during the last 2 years?", (4 and 5) "have you ever felt that you lost control while eating and were not able to stop before you have eaten far too much?" (this question was divided between "the last six months before pregnancy" and "now"), (6) "is it important for your self-image that you maintain a certain weight?". Based on the weight control variables, principal component analysis (PCA) and reliability analysis were performed, which resulted in two scales that measured weight control. One scale consisted of the two loss of control of eating-variables ("have you ever felt that you lost control while eating and were not able to stop before you have eaten far too much?") with a Cronbach's alpha value of .87 and mean inter-item correlation was .40. The other scale included the items regarding worried/important with a certain weight ("are you worried about gaining more weight than necessary during this pregnancy?" and "is it important for your self-image that you maintain a certain weight?"), which had a Cronbach's alpha value of .50 and mean inter-item correlation was .21. Despite the low Cronbach's alpha value on the second scale, both were kept in order to see what kind of results it would bring in the further analyses. Intermediary decimals values were added to the weight control variables, in order to capture the answers where the respondent had two different answers on the two questions (e.g. "yes" and "infrequently" were coded as 2.5).

Table 1

Descriptive Results for Dependent Variables, Independent Variables and Covariates

Child and mother variables	n	Mean
Child variables		
BMI		
Normal weight (SD = 1.04)	15759	15.27
Overweight (SD = 0.50)	2110	17.81
Obese (SD = 0.78)	178	19.97
Breakfast (at home/ kindergarten) %		
Every day	16952	93.93
Four to six times a week	562	3.11
Two to three times a week	211	1.17
Once a week	15	0.08
Never/rarely	20	0.11
Internalising (SD = 0.26)	18018	0.40
Externalising (SD = 0.31)	18015	0.41
Sociability (SD = 0.30)	17993	1.56
Gender %		
Boy	9210	51.0
Girl	8811	48.8
TV in child room %		
Yes	1388	7.7
No	16509	91.5
Hours TV/DVD or PC/TV-games %		
Never	50	0.28
Less than one hour	1446	8.01
From one to three hours	13858	76.79
From three to five hours	2578	14.28
Five hours or more	45	0.25
How often PC %		
Daily	442	2.4
Four to six days a week	1043	5.8
Two to three days a week	2860	15.8
One day a week	5207	28.9
Never/rarely	8386	46.5
Number of children in household		
Children older than nine years (SD = 0.85)	4903	1.03
Children from five to nine years old (SD = 0.55)	9773	1.34
Children three or four years old (SD = 0.56)	5666	0.58
Children newborn to three years old (SD = 0.54)	8353	0.82
Mother variables		
BMI %		

Normal weight	12535	21.83
Overweight	3959	26.97
Obese	1553	33.65
Education (mother) (finished and ongoing education) %		
Elementary school (9 years)	205	1.14
1-2 years of high school	577	3.20
Vocational high school	1872	10.37
Genereal high school	1856	10.28
College, university (until 4 years)	8218	45.54
College, university (more than 4 years)	4878	27.03
Education (father) (finished and ongoing education) %		
Elementary school (9 years)	607	3.36
1-2 years of high school	819	4.54
Vocational high school	4087	22.65
Genereal high school	1728	9.57
College, university (until 4 years)	5218	28.91
College, university (more than 4 years)	4484	24.85
Marital status %		
Married	9205	51.01
Divorced/separated	35	0.19
Partner (cohabitant)	8192	45.39
Widow	2	0.01
Single	276	1.53
Other	160	0.89
Mother living with child's father %		
Yes	16457	91.19
No	1332	7.38
Have never lived with him	191	1.06
Self-esteem %		
Very negative	83	0.46
Negative	2448	13.56
Positive	12107	67.09
Very positive	3065	16.98
SCL-5 %		
Not bothered	17223	95.43
A bit bothered	626	3.47
Bothered quite a lot	68	0.38
Bothered a lot	9	0.05
Physical activity (breathless/sweaty) during pregnancy &		
Never	2515	13.94
Less than once a week	4443	24.62

Once a week	3635	20.14
Twice a week	3667	20.32
Three to four times a week	2490	13.80
Five times a week	683	3.78
Physical activity (breathless/sweaty) before pregnancy %		
Never	1253	6.94
Less than once a week	2912	16.14
Once a week	3032	16.80
Twice a week	4570	25.32
Three to four times a week	4614	25.57
Lost control over eating		
No	12641	70.04
No and infrequently	1414	7.84
Infrequently	2622	14.53
Yes and infrequently	468	2.59
Yes, at least once a week	667	3.70
Worried/important with a certain weight		
No	4362	24.17
No and quite important/somewhat worried	6727	37.27
Quite important/somewhat worried	4675	25.90
Yes and quite important/somewhat worried	1453	8.05
Very important and worried	626	3.47

Plan of Analysis

Temperament scales were constructed using principal component analysis (PCA) and further tested with reliability analysis. One-way analysis of variance (ANOVA) and Pearson chi-square test of independence (with Yates continuity correction) were conducted to test category differences regarding the dependent variables child BMI (normal weight and overweight/obese) and breakfast consumption (daily and not daily) with the different independent variables and covariates. ANOVA is used when one wants to compare two groups or more, and it yields the same results when it comes to significance as t-tests (Field, 2013). Post-hoc tests were not performed since the ANOVA was used to indicate which variables that would be further tested with logistic regression. Pearson chi-square test of independence was used to investigate the categorical independent variables/covariates, whereas the continuous variables were analysed with ANOVA. These two analyses were thus used to evaluate which variables that might have an association with the two dependent variables, and to be analysed with logistic regression.

Binary logistic regression was employed to predict categorical outcomes; weight and breakfast. The regression analysis predicts likelihood of category membership through the information of odds ratios (Field, 2013). In relation to the hypotheses, it was tested whether scoring high on the externalising temperament dimension might indicate higher odds of being overweight, and whether scoring high on the externalising temperament dimension might be related to lower odds of eating breakfast every day. The independent variables were controlled for by the covariates.

Results

Temperament Scales

A principal component analysis (PCA) was carried out with the temperament and activity variables. The correlation matrix showed values above .3, though some values were below this point. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy had a value of .86, which indicates that the correlation patterns are compact and that the PCA consists of reliable factors, as .6 is regarded as the minimum value for a sufficient PCA (Field, 2013). Bartlett's Test of Sphericity was significant ($p < .01$), which further indicated that a PCA was suitable. Furthermore, the 'communalities' table showed that all the components had values above .3, which meant that none of them had to be removed yet. Nine components had eigenvalues above 1. The Kaiser's criterion, which the eigenvalues are based on, has been criticised for suggesting too many factors (Field, 2013), therefore one can use information from Catell's scree plot and parallel analysis in order to select how many components to extract. Catell's scree plot indicated several cut points, one at 3 another at 7 and one at 9, indicating either to retain two, six or eight factors. Parallel analysis can also be used to assess how many components to extract, calculating eigenvalues based on randomly generated correlation matrices that one can compare to the ones in the data set (Pallant, 2013; Patil, Singh, Mishra & Donovan, 2007). To conduct a parallel analysis, an online engine was employed (Patil et al., 2007). Comparing the values from the parallel analysis with the eigenvalues from the PCA showed that the first six factors met the criteria.

The "component matrix" from the PCA showed that most variables loaded on factor 1 and 2 and that further loadings were scattered across the other factors. In addition, very few variables loaded on factor 6 and above, therefore, it was decided to start with extracting five factors, using orthogonal varimax rotation. Varimax was used because this rotation method creates easily interpretable component loadings and also reduces the number of variables that have high loadings on each component (Field, 2013). Since there were only a few variables in some of the components in the five-factor-solution and since some variables loaded on several

factors, a PCA extracting four factors was executed. The variables fitted in well with four factors, but the fourth factor, that concerned activity, consisted of both hyperactivity and general activity items. Therefore it was decided to extract three factors in order to see how the variables then would be organised.

Table 2

Factor Loadings for PCA with Varimax Rotation of Tree Factor Solution of Temperament

Item	Pattern coefficients			Communalities
	Externalising	Internalising	Sociability	
Can't sit still, restless or hyperactive	**.68**	-.04	-.02	.47
Can't concentrate, can't pay attention for long	**.61**	.06	-.06	.38
Can't stand waiting; wants everything now	**.60**	.25	.01	.42
Quickly shifts from one activity to another	**.57**	.08	.04	.34
Demands must be met immediately	**.54**	.32	.01	.39
Your child is always on the go	**.54**	-.28	.26	.44
Your child is off and running as soon as he/she wakes up in the morning	**.49**	-.25	.17	.33
Gets in many fights	**.47**	.25	.04	.28
Punishment doesn't change his/her behaviour	**.47**	.14	-.07	.24
Your child reacts intensely when upset	**.45**	.44	.02	.40
Defiant	**.45**	.36	.02	.33
Hits others	**.44**	.10	-.07	.21
Your child prefers quiet, inactive games to more active ones	**-.41**	.32	-.21	.32
Gets into everything	**.38**	.22	.19	.23
Your child cries easily	.07	**.70**	.00	.49
Your child gets upset (or sad) easily	.34	**.65**	.04	.54
Cries a lot	.12	**.61**	.06	.39

Feelings are easily hurt	.08	**.58**	-.02	.34
Clings to adults or too dependent	.21	**.46**	-.18	.29
Too fearful or anxious	.02	**.45**	-.17	.23
Nervous, highstrung, or tense	.11	**.44**	-.12	.22
Self-conscious or easily embarrassed	-.02	**.44**	-.33	.30
Afraid to try new things	-.05	**.43**	-.29	.27
Your child likes to be with people	-.05	-.03	**.77**	.60
Your child is very sociable	.04	-.17	**.73**	.56
Your child finds other people more stimulating than anything else	.03	.04	**.71**	.51
Your child prefer playing with others rather than alone	.06	.06	**.60**	.36
Your child is very friendly with strangers	.02	-.19	**.60**	.39
Your child takes a long time to warm up to strangers	-.04	.30	**-.57**	.42

Note. Highest factor loading for each variable appear in bold.

The variables with too low values were removed. In the final analysis, all the variables had values above .3 in the rotated component matrix (Table 2). An analysis with oblique direct oblimin rotation was executed to compare with the varimax solution. The two rotations methods created the same pattern apart from one variable that loaded stronger on a different factor.

Table 3

Eigenvalues and Percentages of Variance from PCA of Temperament Variables with Varimax Rotation

	Eigenvalue	% of variance	Cumulative %
Factor 1 externalising	4.98	17.17	17.17
Factor 2 internalising	3.83	13.22	30.39
Factor 3 sociability	1.87	6.46	36.85

Note. KMO = .84. Bartlett's test of sphericity < .001.

The PCA with three factors showed that the KMO value had decreased from .86 to .84, still exceeding the required value. Bartlett's test of sphericity was still significant (< .01). The eigenvalues, explained variance for each factor, and the cumulative variance for the three factors with varimax rotation are shown in Table 3.

Although some variables loaded on several factors and some had low communalities values (< .3) (see Table 2), it was decided to keep the factors for now, and test them with reliability analysis for further inspection.

Table 4

Reliability Analysis of Factor 1:Externalising Temperament

Items	The corrected item-total correlation	Cronbach's alpha if item deleted
Can't sit still, restless or hyperactive	.48	.78
Can't concentrate, can't pay attention for long	.44	.79
Can't stand waiting; wants everything now	.58	.77
Quickly shifts from one activity to another	.42	.79
Demands must be met immediately	.56	.77
Gets in many fights	.47	.79
Punishment doesn't change his/her behaviour	.39	.79
Your child reacts intensely when upset	.47	.78
Defiant	.49	.78
Hits others	.37	.79
Gets into everything	.38	.79

Note. Cronbach's alpha = .80. Mean inter-item correlation = .27 (minimum = .16 and maximum = .59).

Some variables in the externalising scale (Table 4) had to be removed due to values below .3 on the *corrected item-total correlation* (indicating whether each item correlates with the total

score) or because of higher value than the general Cronbach's Alpha value on the *Cronbach's alpha if item deleted*-measure. The Cronbach's alpha value for the externalising scale was .80, which indicates good internal consistency. The mean Inter-Item Correlation value was quite low (.27).

Table 5

Reliability Analysis of Factor 2: Internalising Temperament

Items	Corrected item-total correlation	Cronbach's alpha if item deleted
Your child cries easily	.52	.72
Your child gets upset (or sad) easily	.45	.73
Cries a lot	.42	.73
Feelings are easily hurt	.45	.73
Clings to adults or too dependent	.42	.73
Too fearful or anxious	.40	.74
Nervous, highstrung, or tense	.39	.74
Self-conscious or easily embarrassed	.44	.73
Afraid to try new things	.39	.74
Your child takes a long time to warm up to strangers	.38	.74

Note. Cronbach's alpha = .75. Mean inter-item correlation = .24 (minimum = .10 and maximum = .62).

One item ("your child takes a long time to warm up to strangers") was moved from the sociability scale to the internalising scale, which increased the Cronbach's alpha value on both scales. The Cronbach's alpha value for the internalising scale was .75, which indicates good internal consistency. The mean inter-item correlation value was quite low (.24).

Table 6

Reliability Analysis of Factor 3: Sociability

Items	Corrected item-total correlation	Cronbach's alpha if item deleted
Your child likes to be with people	.62	.65
Your child is very sociable	.48	.71
Your child finds other people more stimulating than anything else	.59	.64
Your child prefer playing with others rather than alone	.49	.72

Note. Cronbach's alpha = .74. Mean inter-item correlation = .44 (minimum = .29 and maximum = .53).

Two items were removed from the sociability scale, due to low values on the *corrected item-total correlation* (< .3) and because of too high *Cronbach's alpha if item deleted*-value. After removing the two variables, the Cronbach's alpha value was .74, which in addition to indicate good internal consistency also supported the removal of the two variables. The mean inter-item correlation value was moderate (.44).

Analysis of Variance and Pearson Chi-square Test of Independence

For the analyses, the variables were organised so that a higher score indicates more of what it is measuring. Means, standard deviations, F-ratios, Pearson chi-square values and levels of significance of the independent variables and covariates in relation to child weight status and breakfast habits are showed respectively in Table 6 and Table 7.

Table 7

One-Way Analysis of Variance and Pearson Chi-Square Test of Independence of Child Weight Status

	Normal weight (n = 15759)		Overweight/ obese (n = 2288)		F/x^2	*p*
	Mean	SD	Mean	SD		
Child variables						
Internalising (0-2)	0.40	0.26	0.39	0.25	6.64	.010
Externalising (0-2)	0.40	0.31	0.42	0.32	7.06	.008
Sociability (0-2)	1.56	0.30	1.56	0.30	0.26	.773
Daily breakfast (%)	95.5		95.2		0.19	.662
Gender (boy) (%)	51.2		50.2		0.87	.351
Hours TV/PC (1-5)	3.06	0.49	3.10	0.49	8.07	.005
Number of children in household	1.94	0.90	1.95	0.90	0.20	.651
Mother variables						
Education (high) (%)	79.7		75.6		20.29	.000
Marital status (married/partner) (%)	97.4		97.0		1.41	.236
Self-esteem (1-4)	3.03	0.57	3.02	0.58	0.76	.385
SCL-5 (1-4)	1.04	0.23	1.05	0.25	0.49	.485
Physical activity during pregnancy (less than twice a week) (%)	60.9		60.1		0.39	.533
Physical activity before pregnancy (less than twice a week) (%)	40.9		41.7		0.46	.497
BMI (overweight/obese) (%)	28.7		43.1		192.57	.000
Lost control over eating (1-3)	1.29	0.53	1.34	0.57	17.11	.000
Worried/important with a certain weight (1-3)	1.64	0.51	1.68	0.54	17.12	.000

Table 8

One-Way Analysis of Variance and Pearson Chi-Square Test of Independence of Child Breakfast Habits

	Daily breakfast (n = 16952)		Not daily breakfast (n = 808)		F/x^2	*p*
	Mean	SD	Mean	SD		
Child variables						
Internalising (0-2)	0.40	0.26	0.44	0.26	16.55	.000
Externalising (0-2)	0.40	0.31	0.47	0.33	41.39	.000
Sociability (0-2)	1.56	0.30	1.55	0.30	1.55	.214
BMI (overweight/obese) (%)	12.7		13.2		0.19	.662
Gender (boy) (%)	51.3		47.6		4.13	.042
Hours TV/PC (1-5)	3.06	0.49	3.14	0.58	21.41	.000
Number of children in household	1.86	0.97	1.70	0.90	16.53	.000
Mother variables						
Education (high) (%)	79.5		72.0		25.50	.000
Marital status (married/partner) (%)	97.5		95.0		17.64	.000
Self-esteem (1-4)	3.03	0.57	2.92	0.57	26.26	.000
SCL-5 (1-4)	1.04	0.23	1.07	0.27	7.82	.005
Physical activity during pregnancy (less than twice a week) (%)	60.6		64.3		4.00	.046
Physical activity before pregnancy (less than twice a week) (%)	40.9		43.9		2.64	.104
BMI (overweight/obese) (%)	30.3		39.0		27.20	.000
Lost control over eating (1-3)	1.30	0.53	1.38	0.60	18.48	.000
Worried/important with a certain weight (1-3)	1.64	0.51	1.73	0.52	22.07	.000

Logistic Regression Analysis

Stepwise logistic regression and direct logistic regression analyses were performed in order to measure the associations between the different variables to child weight status and breakfast habits. In the analyses, the three temperament variables (internalising, externalising,

and sociability) were entered with forced entry in the first block, whereas the other independent variables were entered with forward conditional entry in the second block. In addition, separate direct logistic regression analyses showing the unadjusted values were performed for each independent variable with child weight status and breakfast habits.

Table 9

Association of Child and Maternal Variables with Child Weight Status (Overweight/Obese)

		Unadjusted				Adjusted			
		OR	95% CI		*p*	OR	95% CI		*p*
Child	**Forced entry**								
	Internalising	0.80	0.67	0.95	.010	0.68	0.56	0.84	.000
	Externalising	1.21	1.05	1.39	.008	1.30	1.11	1.53	.001
	Sociability	1.02	0.88	1.18	.773	0.98	0.84	1.15	.810
Mother	**Stepwise entry**								
	Education (both parents)	0.79	0.71	0.87	.000	1.16	1.04	1.30	.007
	BMI mother	1.88	1.71	2.05	.000	1.78	1.62	1.96	.000
	Worried/important to keep certain weight	1.19	1.10	1.30	.000	1.12	1.03	1.23	.006

Note. OR = odds ratio; CI = confidence intervals. R^2 = .275 (Hosmer & Lemeshow), R^2 (internalising temperament) = .001(Nagelkerke), R^2 (externalising temperament) = .001 (Nagelkerke).

Regarding weight status, the model with all predictors was statistically significant, x^2 (14, N = 16697) = 192.27 $p < .001$, suggesting that the model was able to differentiate between the respondents who were overweight/obese and those who had normal weight. The model correctly classified 87.3% of the cases. As shown in Table 9, when adjusted for each other, six of the independent variables/covariates had significant associations with child weight status. Of the adjusted predictors, the mother's BMI was the strongest one, with an odds ratio of 1.78, meaning that the odds that the child is overweight/obese is 1.78 times higher when the mother of the child is overweight/obese. Internalising temperament had an (adjusted) odds ratio value of less than 1 (0.68), which implies that for every unit increase on the internalising scale, the odds that the child is overweight/obese is 0.68 times lower. The Hosmer and Lemeshow test was not significant (.275), which supports the model and indicates a good fit.

However, Nagelkerke R square values for temperament were low; accordingly 0.1% of the variability is explained by the internalising and 0.1% by the externalising temperament.

Table 10

Association of Child and Maternal Variables with Child Breakfast Habits (Not Daily Breakfast)

		Unadjusted				Adjusted			
		OR	95% CI		*p*	OR	95% CI		*p*
Child	**Forced entry**								
	Internalising	1.69	1.31	2.18	.000	1.15	0.84	1.57	.384
	Externalising	1.98	1.60	2.44	.000	1.57	1.22	2.03	.000
	Sociability	0.86	0.68	1.09	.214	0.91	0.70	1.17	.461
	Stepwise entry								
	Gender	1.16	1.01	1.34	.039	1.22	1.05	1.42	.009
	Hours TV/PC	1.40	1.21	1.61	.000	1.38	1.19	1.60	.000
Mother									
	Education (both parents)	0.66	0.56	0.77	.000	1.34	1.13	1.59	.001
	Marital status	2.05	1.47	2.85	.000	1.84	1.29	2.61	.001
	BMI mother	1.47	1.27	1.70	.000	1.30	1.11	1.52	.001
	Worried/important to keep certain weight	1.37	1.20	1.57	.000	1.22	1.06	1.41	.006
	Self-esteem	0.73	0.64	0.82	.000	0.85	0.75	0.97	.019

Note. OR = odds ratio; CI = confidence intervals. R^2 = .582 (Hosmer & Lemeshow), R^2 (externalising temperament) = .007 (Nagelkerke).

The model for breakfast habits including all predictors was statistically significant, x^2 (14, N = 16455) = 119.61, $p < .001$, which indicates that the model was able to differentiate between the respondents who had daily breakfast and those who had not. The model correctly classified 95.6% of the cases. When adjusted for each other, eight of the independent variables/covariates had significant associations with child breakfast habits, as shown in Table 10. Marital status was the strongest predictor, with an odds ratio of 1.84, meaning that the odds that the child was not eating daily breakfast is 1.84 times higher when the parents are divorced/separated/single. Self-esteem had an odds ratio value of less than 1 (0.85), which

implies that for every unit increase on the self-esteem scale, the odds that the child is not eating daily breakfast is 0.85 times lower. The Hosmer and Lemeshow test was not significant (.582), which supports the model. Externalising temperament explained 0.7% of the variability in the model.

Discussion

The aim of this study was to investigate the relationship between child temperament and weight status, and between temperament and breakfast habits. Furthermore, several covariates were investigated in relation to weight and breakfast. There were two main hypotheses: (1) children with externalising temperament are more likely to be overweight or obese, (2) children with externalising temperament are more likely not to eat breakfast every day.

The results showed, when controlling for other variables, that children who scored higher on the externalising scale were at a greater risk of being overweight/obese. Those who scored higher on the internalising scale had lower odds of being overweight/obese. Externalising was the only temperament related to breakfast habits, with higher scores indicating lower odds of the child eating daily breakfast. The third temperament dimension, sociability, was not significantly associated with neither weight nor breakfast habits. However, from the logistic regression analyses it was evident that the temperaments' explained variability of both breakfast and weight status were quite low, so the clinical relevance of these associations might be poor. This thesis study has shown for the first time that an association between temperament and weight appears when using the MoBa sample. This supports an assumption that the association between temperament and overweight perhaps needs time to emerge – that the children may need several years with too high caloric intake due to temperament before the association may be established. Additionally, an association between temperament and breakfast consumption is a novel and interesting finding.

Temperament and Weight Status

Cross-sectional studies that have investigated the same association between temperament and weight have mostly assessed different age categories. In a study measuring children between six and 12 years of age, there were associations of overweight related to low benevolence and low conscientiousness (Vollrath, Hampson, & Júlíusson, 2012). The two characteristics that were linked to overweight, low benevolence and low conscientiousness can be comparable to some of the traits characterising the externalising temperament dimension in this thesis study, for instance demanding, defiant, and impatient. An association

between externalising behaviour (delinquent and aggressive) and overweight was found in an older sample with children between 10 and 12 years of age (Hwang et al., 2006). The externalising problems-traits addressed by Hwang et al. (2006) can also be compared with some of the traits in the externalising dimension in this thesis study, for example "hits others" and "gets in many fights". Some cross-sectional studies that have investigated infants ranging from three to 34 months have found associations between temperamental negativity (fussing, crying, bad mood) and heavier weight or more rapid weight gain (Carey, 1985; Stifter et al., 2011). The "fussy" temperament trait might represent some of the elements in the externalising temperament dimension connected to being impatient and demanding.

Several studies that have similar results regarding temperament and overweight as this thesis study, have been prospective in design (Agras et al., 2004; Anzman & Birch, 2009; Anzman-Frasca et al., 2013; Carey et al., 1988; Darlington & Wright, 2006; Faith & Hittner, 2010; Slining et al., 2009; Wells et al., 1997; Wu et al., 2011). Prospective studies are useful as they can indicate more causal directions than cross-sectional studies. One study investigated children when they were one year old and six years old and found that low attention span in boys was associated with overweight (Faith & Hittner, 2010). This is in line with the results from this thesis study, where several attentional deficits were included in the externalising dimension. Another study that followed children from birth to the age of nine and a half, found association between negative emotionality and overweight (Agras et al., 2004). However, there were both internalising and externalising traits included in the same dimension in that study (Agras et al., 2004), so it is unclear whether the internalising and externalising traits differed in associative strength. The same problem in comparing results with the ones from this thesis study occurred with a study by Wu et al. (2011), where externalising and internalising traits were combined to measure a general difficulty in children followed from infancy to the ages of 10 to 12. However, both studies showed indications for association between externalising characteristics and overweight. One study found associations from childhood to early adolescence, where low inhibitory control was related to heavier weight and weight gain (Anzman & Birch, 2009), which is comparable to the components of impatience and hyperactivity in the externalising scale in the present thesis study. Carey et al. (1988) found associations between difficult elements of temperament (for instance negative mood and poor adaptability) and rapid weight gain in children between four and nine years of age, and this poses the same comparison problem since that study also combined externalising and internalising components.

Some studies have found associations between weight gain and temperament in infants during the first 18 months (Darlington & Wright, 2006; Slining et al., 2009). Darlington and Wright (2006) found the same pattern as this thesis study, with negative emotionality related to fast weight gain, and fear related to slow weight gain, as fear was a component in the internalising scale in the present thesis study. In the study by Slining et al. (2009), distress to limitations was associated with later increased weight. In accordance with Slining et al. (2009), a study indicated that infants that were irritable and easily distressed, were more likely to be overweight later in childhood (Wells et al., 1997), which shows the same pattern as the present thesis study's association between higher BMI and impatient and demanding traits in the externalising temperament dimension. Furthermore, another study also found associations between weight gain was and distress to limitations in infants and children (Anzman-Frasca et al., 2013), although only combined with maternal low parenting self-efficacy.

Possible Mechanisms and Explanations Behind Temperament and Weight Status

Since this thesis study was cross-sectional, no inferences about the causal direction of the results can be made. Thus, reasons for the associations of temperament with overweight can only be speculated on, as is the case also for the covariates' relation to the dependent variables. The finding that elements in the externalising dimension is connected to overweight is in accordance with the pattern of several of the studies investigating temperament and overweight. There are different assumptions regarding the relation between overweight and temperament. One of them is that temperament elicits responses in the environment that affects the weight, but the opposite – that weight is influencing the temperament have also been proposed (Anzman-Frasca et al., 2012; Bergmeier et al., 2014; Snethen, Hewitt, & Goretzke, 2007).

Self-regulation connected to eating is a frequently cited possibility for the association between temperament and weight (Fisher & Birch, 2002; Graziano et al., 2012). Self-regulation can be related to traits like hyperactivity, impulsiveness and reward sensitivity since they also entail control and attentional aspects (van den Berg et al., 2011; Braet et al., 2007; Faith & Hittner, 2010; Francis & Susman, 2009; Hartmann, Czaja, Rief, & Hilbert, 2010; Temple et al., 2008). In this thesis study, there were several attention deficits/hyperactivity items included in the externalising temperament dimension, which was associated with overweight. This can indicate some support for the proposed connection between self-regulation/reward sensitivity and overweight.

Feeding to soothe might be a mechanism behind the relation between temperament and overweight (Agras et al., 2004; Bergmeier et al, 2014; Braet & van Strien, 1997; Carey, 1985; Darlington & Wright, 2006; Stifter et al., 2011; Vollrath et al., 2011). Although feeding to soothe have been mentioned mostly in studies with younger samples, it can occur at older age as well. It can be assumed that feeding to soothe for five-year-olds can work in several ways. One way is by parents offering calming and comforting food to the child when he or she is defiant or agitated. Another way might be trough already formed patterns of emotional eating that could result from learned associations of food as being soothing from early age.

Since some of the factors in externalising temperament was related to being impatient, defiant and displaying anger, one can speculate whether these traits facilitates behaviour in the environment that affects the weight, for instance food to soothe that further causes increased caloric intake.

Temperament and Breakfast/Eating Habits

Some studies have linked temperament or certain personality traits to other eating and food intake aspects. In a cross-sectional study using a different Norwegian sample, assessing children between six and 12 years of age, associations were found between traits including neuroticism, low benevolence and low conscientiousness and more consumption of sweet drinks (Vollrath, Hampson, & Júlíusson, 2012). The components in Vollrath, Hampson, & Júlíusson's (2012) study can be comparable to the ones in the present study's externalising dimension. A prospective longitudinal study examining children from three to seven years of age, also using the Norwegian MoBa-sample, found that both internalising and externalising temperament were associated with consumption of sweet food and drinks (Vollrath, Stene-Larsen et al., 2012). In addition, those with externalising temperament were less likely to consume fruit and vegetables daily (Vollrath, Stene-Larsen et al., 2012), indicating unhealthy aspects related to externalising temperament. Furthermore, another prospective study discovered indications for higher carbohydrate-consumption at follow-up when the children were two/three years old, among those who were regarded as restless and irritable as infants (Wells et al., 1997). In addition, a cross-sectional study that examined pre-schoolers uncovered that negative affectivity (characterised by anger, unstable mood and dysregulated emotions) was associated with having tantrums when denied food (Leung et al., 2014).

Based on these studies, there seems to be a connection between externalising temperament and unhealthy diet or eating/feeding difficulties. Some of the traits that are shared by the studies are anger, defiant, irritable, unstable mood, low benevolence, and restlessness. Since there are no studies linking temperament to breakfast, neither

longitudinally nor cross-sectionally, one can only speculate behind mechanisms behind the association that was shown. As several of the externalising components have been linked by different studies to eating difficulties and unhealthy eating patterns, one can hypothesize whether for example defiant or impatient children refuse to eat breakfast, or want to eat only according to their wishes, or whether they are picky with what type of food they want to eat. Perhaps serving breakfast to the child becomes a struggle for the mother, and the end result is no breakfast.

Although several studies have uncovered associations between child weight and eating habits, this was not found in the present study. Possibly, there might be a stronger relation between weight and breakfast when the children are older than five years of age, and more in charge of their own breakfast.

The Covariates

Maternal body mass index. The present thesis has shown that maternal BMI had the highest odds ratio value of all the independent variables related to child overweight. If the child had a mother who was overweight/obese, it was almost two times more likely that the child would also be overweight/obese, compared to normal weight mothers. This is in line with several studies where parental weight had significant associations with child overweight (Agras et al., 2004; Agras & Mascola, 2005; Burke et al., 2001; Faith & Hittner, 2010; Pryor, 2011; Whitaker, 2004).

Maternal overweight was also positively associated with the child not eating daily breakfast. Children's dietary patterns are highly influenced and structured by their parents, so not eating breakfast regularly might indicate an unhealthy lifestyle (Birch & Anzman, 2010; Brekke et al., 2007; Fisher et al., 2002; Vereecken et al., 2004). Also, parental modeling is important when it comes to dietary habits (Birch & Anzman, 2010; Vereecken et al., 2004), possibly if the mother is not eating breakfast, the child may not eat either. Based on the results from the thesis study and the existing literature, genetics and environmental influences seem to have central roles when it comes to the development of childhood overweight and obesity. Although not found in this study, skipping breakfast has been related to higher BMI in children and adults (Smith et al., 2010).

Parental education/socioeconomic status. This thesis study has shown that parental education level was significantly associated with child overweight. The child had higher probability of being overweight/obese if both parents had a low educational level compared to children with one or two parents with college/university education. This is in accordance with several studies that have linked socioeconomic status and education to overweight (Brekke et

al., 2007; Danielzik et al., 2004; Dubois & Girard, 2006; Fernández-Alvira et al., 2013; Flores & Lin, 2013; Grydeland et al., 2012; Hawkins et al., 2008; Shrewsbury & Wardle, 2008; Thorisdottir et al., 2013). In addition, breakfast habits were also associated with parental education level. If one or both parents had lower education, the odds that the child was not eating daily breakfast were higher than they were for other children. On the background of this literature and the finding in the present thesis study, it can be assumed that it is the healthy lifestyle that often follows with higher education that protects children from being overweight or obese. Highly educated parents might be more knowledgeable and concerned about nutrition, physical activity, and other healthy lifestyle choices, and many of them might also be able to afford more healthy food because of higher income (Birch & Anzman, 2010; Thornton, Pearce, & Ball, 2013).

Television/computer and sedentariness. How many hours a child watched television or used a computer was significantly associated only with child breakfast, and lacked an association with child weight. The odds for not eating daily breakfast were higher for every unit increase in the number of hours on the watching television/using computer scale, meaning that the more the child watched television/used computer during the week and the weekend, the more likely it was that the child was not eating daily breakfast. The association between breakfast and television/computer use is possibly explained by the fact that lack of breakfast can illustrate an unhealthy and/or irregular lifestyle. The fact that television and breakfast may be representatives of a more general behaviour is reflected also in other studies (Must et al., 2009). Moreover, breakfast can represent household routines, since five-year-olds rarely are responsible for their breakfast. Thus not eating breakfast regularly can indicate poorer routines when it comes to eating/feeding habits, which can further be associated with a sedentary lifestyle with television/computer use as an indicator.

It remained unclear why television viewing/computer use was not associated with child weight when controlling for other variables in the present study, as several other studies have found relations between television watching and weight (Andersen et al., 2005; Dennison et al., 2002; Grydeland et al., 2012; Marshall et al., 2004; Müller et al., 1999; Musaiger et al., 2014; Parsons et al., 2008; Wake et al., 2003). It might be that viewing/use of television and computers was lower in this population compared to other populations, and thus was not significantly associated with weight. Also, it might be other measures of sedentariness and physical activity that were more influential on this sample. The age of the thesis' sample could also be an explanation, but several of the studies that found associations between television viewing and overweight had five-year-olds in their sample as well.

"Worried/important to keep certain weight" and self-esteem. The maternal item "worried/important to keep certain weight" was related to both child weight and breakfast habits. The odds that the child was overweight increased with higher score on the worried/important to keep certain weight-scale, indicating more worry and degree of importance. For not having daily breakfast, the odds were also higher with increase on the "worried/important to keep certain weight"-scale. Somewhat likewise, a study by Francis, Hofer, and Birch (2001) found indications for associations between maternal weight concerns and child feeding practices. In the present study, the mothers' self-esteem was significantly associated with child breakfast, indicating that lower self-esteem was related to no daily breakfast of the child. Self-esteem has also been implicated in other studies with child feeding practices, where negative affectivity (mental health problems and low self-esteem) was related to both pressuring to eat and restricting the child's food intake (Ystrom, Barker, & Vollrath, 2012) and also associated with higher child intake of sweets (Vollrath, Stene-Larsen et al., 2012). Furthermore, a study by Farrow and Blissett (2006) showed that low maternal self-esteem, together with perceived difficult child temperament, were related to feeding problems. Taken together, there might be a pattern between low maternal self-esteem/worth and unhealthy child feeding/eating patterns.

Parental marital/partner status. Marital status had the highest odds ratio when it came to breakfast habits, where the odds that the child was not eating daily breakfast was higher for children with single, separated or divorced mothers, compared to children whose parents were married/partners. This is in line with a study where skipping breakfast among children between two and five years of age was associated with having single parents (Küpers et al., 2014). It has been suggested that single parents might be less restrictive when it comes to unhealthy eating (Hesketh et al., 2007) or perhaps that they have less control when it comes to meals. In accordance with this, Brekke et al. (2007) found indications for an association between children who had single mothers and a higher frequency of food low in nutrition and high in sugar. Furthermore, a study showed that there was a higher consumption of soft drinks among daughters of single mothers (Elfhag & Rasmussen, 2008), possibly linked to a generally poorer diet. The marital status can presumably indicate the home status, and perhaps also income level, which is further related to eating habits.

Child gender. The results indicated that girls were less likely to eat breakfast every day than were boys. This is in line with several other studies (Cohen, Evers, Manske, Bercovitz, & Edward, 2003; Haug et al., 2009; Lazarou, Panagiotakos, Kouta, & Matalas, 2009; O'Dea & Caputi, 2001; Siega-Riz et al., 1998). One of the studies included use of data

from the WHO collaborative Health Behaviour in School-aged Children (HBSC) study (where Norway participated), and found that in 30 countries, boys consumed daily breakfast more frequently than did girls (Haug et al., 2009). This advocates for a distinct pattern when it comes to gender and breakfast consumption. However, the age categories ranged from six to 19 years of age, with most of the studies including mainly adolescents in their sample.

Limitations

The most important limitation was that the MoBa study used self-report/maternal report. Self-report is commonly employed in this field of psychology but it obviously has some disadvantages such as possible biased answers. Especially report of weight can be problematic in self-report surveys. However, some of the elements in the questionnaire would be very time-consuming to measure by observation, so maternal report is unavoidable when it comes to measuring several aspects of temperament. Another limitation is the creation of questionnaires several years ago, for longitudinal purposes. Thus some new environmental elements, especially regarding technology (e.g. smart phones and tablets), could not be included in the present thesis study. Still, television and computer use was included, which represent some present-day media elements. Moreover, it could have been interesting to look more closely at additional eating habits other than breakfast, to obtain a better overview of the children's diet, and hence see whether that would have been associated with the children's BMI. However, such aspects were not included in the five-year-questionnaire. Another limitation of the sample was that the mothers were possibly more health conscious than the general population, in addition to having higher socioeconomic status. Furthermore, since the study was cross-sectional, no inferences about causation could be made.

Conclusion

The results of this study has shown that child weight status was associated with externalising and internalising temperament, in addition to parental education, maternal body mass index, and maternal weight issues ("worried/important to keep certain weight"). The child's breakfast habits were significantly associated with externalising temperament, child gender, children's television viewing/computer use, parental education, parental marital/partner status, maternal body mass index, maternal weight issues ("worried/important to keep certain weight"), and maternal self-esteem. The variety of elements associated with breakfast consumption can possibly illustrate that breakfast eating might be a proxy for a generally structured and healthy life.

The explained variability by the temperament dimensions was low for both weight status and breakfast habits, which may reduce the clinical relevance of the results in this

analysis. Nonetheless, it has been shown that some elements have more influence on breakfast habits and weight status than others in this particular sample, and this is important in the mapping of relevant risk factors Furthermore, this thesis study has shown for the first time an association between child temperament and weight based data from the MoBa sample, which might indicate that in some populations, it takes time before an association might appears. Additionally, the relation between breakfast eating and temperament in children is a novel finding.

Because of the temperaments' low explained variability of the weight status and daily breakfast, there might have been other factors in the study sample that are more relevant for predicting body weight and breakfast eating. Also, the participants' age might have caused the low association, since some factors might be more influential at an older age. Furthermore, there was a quite low prevalence of children not eating daily breakfast, and also a low prevalence of overweight children, which might have affected the results.

Implications and Future Directions

Pre-schoolers, as an age category, have been investigated less with regard to temperament and weight. Future research should further explore this and other age categories to see whether there are some age-sensitive periods connecting overweight and temperament. Particularly longitudinal studies may be relevant in mapping what kinds of factors that are significant, and when they have strongest effect. Also, it could be interesting to investigate the use of newer technologies in relation to sedentariness and weight. Additionally, the novel discovery of an association between temperament and breakfast consumption encourages further studies on this topic.

Since the risk of continuing to be overweight in adulthood increases with the child's age, measures to prevent overweight and obesity, targeting children of young age, seem crucial. Investigation of possible associated factors with a healthy lifestyle is needed, so that health personnel and others can be more aware of how caretakers should respond to their child's behaviour, and how various environmental elements might affect the child's overall health. Since overweight and obesity are increasing in prevalence and can have detrimental long-term effects on children's psychosocial and somatic well-being, more research in this field is needed.

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